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OPTICAL COMPENSATING FILM, METHOD FOR PRODUCING THE SAME, POLARIZING PLATE USING THE SAME AND LIQUID CRYSTAL DISPLAY

Abstract:
PROBLEM TO BE SOLVED: To provide an optical compensating film uniformly having required characteristics in the surface, a method for producing the film, a polarizing plate using the film and a liquid crystal display.
SOLUTION: A thermoplastic resin film is biaxially stretched in the longitudinal direction and in the lateral direction in this order to obtain the objective optical compensating film. When the thickness of the optical compensating film is represented by (d), the intrasurface principal refractive indexes of the film are represented by nx and ny, the principal refractive index in the thickness direction is represented by nz and the relation of nx>ny is satisfied, the intrasurface retardation value (Re=(nx-ny)d) is 0-500 nm, the retardation value in the thickness direction (Rth=(nx-nz)d) is 0-500 nm and the ratio of Re to Rth is <1.

PRIOR ART

[Description of the Prior Art] form birefringence, such as a STN type, was used for various screen display, such as a personal computer and a word processor, -- high -- the contrast liquid crystal display is used In this liquid crystal display, when the incident light made into the linearly polarized light through the polarizing plate turns into elliptically polarized light by the birefringence by the liquid crystal cell and looks at it through a polarizing plate, there is a problem which a display colors yellow or a blue system. Therefore, the FTN method which makes the phase contrast board (optical compensation film) which consists of an oriented film intervene between a liquid crystal cell and a polarizing plate as a means to compensate the phase contrast by the birefringence of a liquid crystal cell that the elliptically polarized light after liquid crystal cell transparency should be returned to the linearly polarized light, and coloring should be prevented is proposed.

[0003] However, in having used the ordinary oriented film as an optical compensation film in the aforementioned FTN method, the angle of visibility which can be narrowly seen by good contrast is also narrow, and the angle of visibility which can be seen as a monochrome display -- a coloring display appears again -- only by changing a view a little is inferior to visibility. Therefore, it is an optical compensation film used for the angle-of-visibility improvement and contrast improvement for liquid crystal displays. When the principal indices of refraction of nx, ny, and the thickness direction are made [the thickness of a film] into nz and nx>ny for the principal indices of refraction in d and a film plane, the film of 0-500nm and Re/Rth<1 is demanded [the retardation value within a field (Re=(nx-ny) d)] for the retardation value (Rth=(nx-nz) d) of 0-500nm and the thickness direction.
[0004] However, it was difficult to be satisfied [with the method only by conventional vertical uniaxial stretching and conventional horizontal uniaxial stretching] of all the properties required of an optical compensation film.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention relates to the optical compensation film used for an angle-of-visibility improvement and contrast improvement of a liquid crystal display, its manufacture method and the polarizing plate using this film, and a liquid crystal display.
[0002]
[Description of the Prior Art] form birefringence, such as a STN type, was used for various screen display, such as a personal computer and a word processor, -- high -- the contrast liquid crystal display is used In this liquid crystal display, when the incident light made into the linearly polarized light through the polarizing plate turns into elliptically polarized light by the birefringence by the liquid crystal cell and looks at it through a polarizing plate, there is a problem which a display colors yellow or a blue system. Therefore, the FTN method which makes the phase contrast board (optical compensation film) which consists of an oriented film intervene between a liquid crystal cell and a polarizing plate as a means to compensate the phase contrast by the birefringence of a liquid crystal cell that the elliptically polarized light after liquid crystal cell transparency should be returned to the linearly polarized light, and coloring should be prevented is proposed.
[0003] However, in having used the ordinary oriented film as an optical compensation film in the aforementioned FTN method, the angle of visibility which can be narrowly seen by good contrast is also narrow, and the angle of visibility which can be seen as a monochrome display -- a coloring display appears again -- only by changing a view a little is inferior to visibility. Therefore, it is an optical compensation film used for the angle-of-visibility improvement and contrast improvement for liquid crystal displays. When the principal indices of refraction of nx, ny, and the thickness direction are made [the thickness of a film] into nz and nx>ny for the principal indices of refraction in d and a film plane, the film of 0-500nm and Re/Rth<1 is demanded [the retardation value within a field (Re=(nx-ny) d)] for the retardation value (Rth=(nx-nz) d) of 0-500nm and the thickness direction.
[0004] However, it was difficult to be satisfied [with the method only by conventional vertical uniaxial stretching and conventional horizontal uniaxial stretching] of all the properties required of an optical compensation film.
[0005]
[Problem(s) to be Solved by the Invention] this invention aims at offering the optical compensation film which has the aforementioned property uniformly in a film plane, its manufacture method and the polarizing plate using this film, and a liquid crystal display in order to solve the above-mentioned conventional problem.
[0006]

[Means for Solving the Problem] In order to attain the aforementioned purpose, the manufacture method of the optical compensation film of this invention is characterized by carrying out biaxial stretching of the thermoplastics film serially in the order of lengthwise and a longitudinal direction. As for the ratio of horizontal draw magnification and vertical draw magnification, it is desirable that it is 0.2-5.0.
[0007] Moreover, when the optical compensation film of this invention manufactured by the aforementioned method makes [the thickness of a film] the principal indices of refraction of nx, ny, and the thickness direction nz and nx>ny for the principal indices of refraction in d and a film plane, the retardation value in a film plane (Re=(nx-ny) d) is characterized by the retardation values (Rth=(nx-nz) d) of 0-500nm and the thickness direction being 0-500nm and Re/Rth<1.
[0008] Moreover, when the optical compensation film of this invention manufactured by the aforementioned method makes [the thickness of a film] the principal indices of refraction of nx, ny, and the thickness direction nz and nx>ny for the principal indices of refraction in d and a film plane, the retardation value in a film plane (Re=(nx-ny) d) is characterized by the retardation value (Rth=(nx-nz) d) of 10-100nm and the thickness direction being [100-300nm and Rth/Re] 1-4.
[0009] Moreover, the optical compensation film of this invention is characterized by crosswise Re distribution being **10% of within the limits in 80% or more of sheet width of face.
[0010] Moreover, a thermoplastics film has a desirable norbornene system resin film.
[0011] Moreover, the polarizing plate of this invention is characterized by being the polarizing plate which consists of a layered product of the aforementioned optical compensation film and a polarizing plate.
[0012] Moreover, the liquid crystal display of this invention is characterized for the aforementioned optical compensation film by the thing of a liquid crystal cell arranged in one side at least.
[0013] Moreover, the liquid crystal display of this invention is characterized for the aforementioned polarizing plate by the thing of a liquid crystal cell arranged in one side at least.
[0014] Since according to the manufacture method of this invention there is no partial contraction (neck in) of the longitudinal direction of the film generated at the time of vertical extension when biaxial stretching is serially carried out in a longitudinal direction and lengthwise order The optical compensation film which the angle of visibility which can be seen as a monochrome display is large when the manifestation of the 2 shaft property of a film becomes easy and uses it for a polarizing plate or a liquid crystal display, the angle of visibility which can be seen by good contrast is also large, and was excellent in visibility can be manufactured.
[0015]
[Embodiments of the Invention] As a thermoplastics film used in this invention, polyolefine system resins, such as polyester system resins, such as a polycarbonate system resin, a polyarylate, and a polyethylene terephthalate, a polyimide system resin, a polysulfone system resin, a polyether sulphone system resin, a polystyrene system resin, polyethylene, and polypropylene, a polyvinyl alcohol system resin, a cellulose acetate system resin, a polyvinyl chloride system resin, a poly norbornene system resin, a polymethylmethacrylate system resin, a liquid crystal polymer, etc. are mentioned. What was manufactured by any of the casting method, the calender method, and an extrusion method is sufficient as a film. Especially, a polycarbonate system resin, a polystyrene system resin, and a poly norbornene system resin are desirable. a poly norbornene system resin -- a photoelasticity coefficient -- comparatively -- small -- flexibility -- it is -- bending stress and shearing stress -- receiving -- a crack -- splitting -- etc. -- since it is hard to be generated, it is especially desirable Especially a limit does not have the weight average molecular weight of thermoplastics, and a proper thing can be used for it.
[0016] Especially limitation does not have the thickness of the thermoplastics film used for extension processing, and it can determine suitably according to the purpose of using the oriented film produced etc. A film with a thickness of 5-500 micrometers is especially used preferably 1 micrometer - 1mm 3mm or less from the point of generally obtaining a homogeneous oriented film by stable extension processing etc.
[0017] In this invention, after extending a thermoplastics film to lengthwise first, it is extended to a degree at a longitudinal direction. Since according to this method the second process (horizontal extension) serves as fixed-end horizontal extension and the neck in of a film can be prevented, the manifestation of the 2 shaft property of a film becomes easy.
[0018] In this invention, roll slowing growth, rolling extension, etc. are used for lengthwise extension, and a tenter is used for lateral extension. As for the rail aperture angle of a tenter, it is preferably good to make it less than 5 times less than 10 degrees. By narrowing a rail aperture angle, the Boeing phenomenon produced at the time of horizontal extension can be suppressed, and the variation in the degree distribution of optic axial angle can be reduced.

[0019] Although the extension temperature of a thermoplastics film changes also with kinds of resin to be used, 80-250 degrees C of 120-200 degrees C of usual are 140-180 degrees C especially preferably preferably.
[0020] As for draw magnification, lengthwise is 1 - double precision especially preferably one to 3 times preferably one to 5 times. Lateral draw magnification is 1 - double precision especially preferably one to 3 times preferably one to 5 times. the ratio of lengthwise draw magnification and lateral draw magnification -- vertical draw magnification / horizontal draw magnification =0.2-5.0 -- it is 0.3-3.0 preferably When exceeding the case where the ratio of the aforementioned draw magnification is smaller than 0.2, and 5.0, the optical compensation film which has the retardation value which each makes the purpose of this invention cannot be obtained.
[0021] After extending, you may establish a relief process suitably. At a relief process, the extended thermoplastics film is held to a predetermined time and predetermined temperature, and an oriented film is shrunk. In this case, as for the rate of relief, it is desirable that it is less than 20%, a retention temperature is within the limits of glass-transition-point (Tg) minus 30degree C to Tg plus 30 degree C of the above-mentioned thermoplastics, and the holding time is 1 second - 60 seconds.
[0022] According to the manufacture method of this invention, when the principal indices of refraction of nx, ny, and the thickness direction are made into nz and nx>ny for thickness [of a film] d, and the principal indices of refraction in a film plane, the retardation value within a field (Re) can produce the optical compensation film whose retardation values (Rth) of 0-500nm and the thickness direction are 0-500nm and Re/Rth<1.
[0023] Moreover, for the retardation value within the aforementioned field (Re), the retardation value (Rth) of 10-100nm and the aforementioned thickness direction is [100-300nm and Rth/Re of the optical compensation film produced by the manufacture method of this invention] 1-4.
[0024] Furthermore, in 80% or more of sheet width of face, the optical compensation film produced by the manufacture method of this invention has crosswise Re distribution in **10% of within the limits, and it is [the variation in Re] excellent in the homogeneity within a field few. That is, when Re of the cross direction of the film produced by extension processing is measured, the rate which has the difference of Re of the center of a film and crosswise Re to less than **10% to Re of the center of a film occupies 80% or more. Although the phase contrast according to the purpose of use etc. can determine the thickness of a film suitably, generally it is 5-300 micrometers especially preferably 1-500 micrometers preferably 1mm or less.
[0025] Even if it uses it by one sheet, you may use the optical compensation film of this invention as a superposition object. Although the number of superposition is arbitrary, superposition of 2-5 sheets is more common than points, such as permeability of light. The combination of the oriented film to superimpose is also arbitrary and same things of the degree of orientation angle and things of the different degree of orientation angle, the things of allotropy material and the things of a different material, the things of the same phase contrast and different things of phase contrast, etc. can be combined suitably.
[0026] Next, the polarizing plate used by this invention is explained.
[0027] The fundamental composition of the polarizing plate used by this invention consists of what pasted up the transparent protection film which serves as a protective layer through the glue line which becomes one side or the both sides of the polarizer which consists of a polyvinyl alcohol system polarization film of dichroism matter content etc. from a proper glue line, for example, vinyl alcohol system polymer etc.
[0028] It is what performed proper processing of the dyeing processing by the dichroism matter which becomes the film which consists of proper vinyl alcohol system polymer which applied, for example to the former, such as polyvinyl alcohol and partial formal-ized polyvinyl alcohol, correspondingly as a polarizer (polarization film) from iodine, a dichromatic dye, etc., extension processing, bridge formation processing, etc. by proper sequence and a proper method, and if incidence of the natural light is carried out, the proper thing which penetrates the linearly polarized light can be used. What is excellent in a light transmittance or degree of polarization especially is desirable. Although the thickness of a polarization film has common 5-80 micrometers, it is not limited to this.
[0029] The bright film proper as a protection film material used as the transparent protection layer prepared in one side or the both sides of a polarizer (polarization film) can be used. The film which consists of polymer which is excellent in transparency, a mechanical strength and thermal stability, moisture cover nature, etc. especially is used preferably. As an example of the polymer, although the acetate system resin like a triacetyl cellulose, a polyester system resin, a polyether sulphone system resin, a polycarbonate system resin, a polyamide system resin, a polyimide system resin, a polyolefine system resin, an acrylic

resin, etc. are raised, it is not limited to this.
[0030] The transparent protection film which can be used especially more preferably than points, such as a polarization property and endurance, is a triacetyl-cellulose film which carried out saponification processing of the front face with alkali etc. Although the thickness of a transparent protection film is arbitrary, generally it is especially set to 5-150 micrometers preferably 5-300 micrometers 500 micrometers or less for the purpose of thin-shape-izing of a polarizing plate etc. In addition, when preparing a transparent protection film in the both sides of a polarization film, it can also consider as the transparent protection film which consists of polymer which is different on the front reverse side.
[0031] The transparent protection film used for a protective layer may perform processing aiming at hard-coat processing, acid-resisting processing, prevention of sticking, diffusion or an anti glare, etc., unless the purpose of this invention is spoiled. A polarizing plate front face gets damaged, and hard-coat processing is performed for the purpose of prevention etc., and can form the hardening coat which is excellent in a degree of hardness, slipping nature, etc. according [for example,] to proper ultraviolet-rays hardening type resins, such as a silicone system, an urethane system, acrylic, and an epoxy system, by the method added to the front face of a transparent protection film.
[0032] On the other hand, acid-resisting processing is performed for the purpose of acid resisting of the outdoor daylight on the front face of a polarizing plate, and formation of the antireflection film according to the former etc. can attain it. Moreover, for the purpose of adhesion prevention with an adjacent layer, anti glare processing is performed for the purpose of prevention of outdoor daylight reflecting on the surface of a polarizing plate, and checking a check by looking of the polarizing plate transmitted light etc., and can form sticking prevention by giving detailed irregularity structure to the front face of a transparent protection film by the method with proper split-face-ized method according [for example,] to a sandblasting method, an embossing method, etc., combination method of a transparent particle, etc.
[0033] The organic system particle which the silica, an alumina, a titania and a zirconia, a tin oxide, the indium oxide and the cadmium oxide, an antimony oxide, etc. whose mean particle diameter is 0.5-20 micrometers are mentioned, and may use the inorganic system particle which has conductivity, and consists of a polymer granular object for which a bridge is not constructed [bridge formation or] can also be used for the aforementioned transparent particle. The amount of the transparent particle used has per [2] transparent resin 100 mass section - 70 mass sections, especially common 5 - 50 mass section.
[0034] The anti glare layer of transparent particle combination can be prepared as the transparent protection film itself or a coating layer to a transparent protection film front face. An anti glare layer may serve as the diffusion layers (viewing-angle compensation function etc.) for diffusing the polarizing plate transmitted light and expanding a viewing angle. In addition, an acid-resisting layer, an above-mentioned sticking prevention layer, above-mentioned diffusion layer, anti glare layer, etc. can also be prepared as a thing of another object with a transparent protection film as an optical layer which consists of a sheet which prepared those layers.
[0035] Especially adhesion processing with the aforementioned polarizer (polarization film) and the transparent protection film which is a protective layer can be performed through the adhesives which consist of a water-soluble cross linking agent of vinyl alcohol system polymer, such as adhesives which consist of vinyl alcohol system polymer or a boric acid and a borax, a glutaraldehyde, and a melamine, oxalic acid, at least, for example, although not limited. Thereby, it shall be hard to separate under the influence of humidity or heat, and shall excel in a light transmittance or degree of polarization. Although this glue line is formed as an application dryness layer of solution etc., it can also blend other additives and the catalyst of an acid etc. if needed on the occasion of manufacture of the solution.
[0036] A polarizing plate can be used as an optical member which carried out the laminating to other optical layers on the occasion of practical use. There is especially no limitation about the optical layer. For example, a reflecting plate and a half-transparency reflecting plate, A phase contrast board (lambda boards, such as 1/2 wavelength plate and 1/4 wavelength plate, are also included), an optical compensation film, an improvement film in brightness of this invention, etc., It can use more than two-layer [of the proper optical layer by which have been used for formation of a liquid crystal display etc. / one layer or two-layer]. The reflected type polarizing plate or half-transparency reflecting plate type polarizing plate with which the laminating of a reflecting plate or the half-transparency reflecting plate was further carried out to the polarizing plate which consists of a polarizer and a protective layer especially, The elliptically-polarized-light board or circular polarization of light board with which the laminating of the phase contrast board is further carried out to the polarizing plate which consists of a polarizer mentioned above and a protective layer, To the polarizing plate which consists of a polarizer mentioned above and a protective layer, the

polarizing plate with which the laminating of the improvement film in brightness is further carried out to the polarizing plate with which the laminating of the optical compensation film of this invention is carried out, or the polarizing plate which consists of a polarizer mentioned above and a protective layer is still more desirable.

[0037] The aforementioned reflecting plate is for preparing it in a polarizing plate and forming a reflected type polarizing plate, and a reflected type polarizing plate is usually prepared in the background of a liquid crystal cell, can form the liquid crystal display of the type which is made to reflect the incident light from a check-by-looking side (display side), and is displayed etc., it can omit built-in of the light sources, such as a back light, and has an advantage, such as being easy to attain thin shape-ization of a liquid crystal display.

[0038] A method with the proper method which attaches the reflecting layer which becomes one side of a polarizing plate from a metal etc. through the transparent protection film described above if needed can perform formation of a reflected type polarizing plate. What attached the foil and vacuum evaporationo film which consist of reflection nature metals, such as aluminum, to one side of the transparent protection film which carried out mat processing as the example if needed, and formed the reflecting layer in it is mentioned.

[0039] Moreover, the reflected type polarizing plate which has the reflecting layer which made the detailed irregularity structure reflect on the above-mentioned transparent protection film which was made to contain a particle and made the front face detailed irregularity structure is mentioned. The reflecting layer of surface detailed irregularity structure diffuses an incident light by the scattered reflection, prevents directivity and the appearance [GIRAGIRA / appearance], and has the advantage which can suppress the nonuniformity of light and darkness. Formation of the reflecting layer of the detailed irregularity structure in which the surface detailed irregularity structure of a transparent protection film was made to reflect can be performed by the method of attaching a metal to the front face of a transparent protection film directly by methods with proper vacuum evaporationo method, plating method, etc., such as for example, a vacuum deposition method, an ion plating method, and a sputtering method, etc.

[0040] Moreover, a reflecting plate can be replaced with the method directly attached to the transparent protection film of the above-mentioned polarizing plate, and can also be used for the proper film according to the transparent protection film as a reflective sheet which comes to prepare a reflecting layer. Since the reflecting layer of a reflecting plate usually consists of a metal, its use form in the state where the reflector was covered with the film, the polarizing plate, etc. is desirable from the point of fall prevention of the reflection factor by oxidization, as a result long-term continuation of an initial reflection factor, the point of evasion of separately an attachment of a protective layer, etc.

[0041] In addition, a half-transparency type polarizing plate can be obtained by considering as the half-transparency type reflecting layer of the one-way mirror which reflects and penetrates light by the reflecting layer in the above. A half-transparency type reflection type polarizing plate can form the liquid crystal display of the type which is made to reflect the incident light from a check-by-looking side (display side), displays a picture, and displays a picture in a comparatively dark atmosphere using the built-in light sources, such as a back light built in the backsight of a half-transparency type polarizing plate, etc., when it is usually prepared in the background of a liquid crystal cell and uses a liquid crystal display etc. in a comparatively bright atmosphere. That is, the half-transparency type polarizing plate is useful under a bright atmosphere to formation of the liquid crystal display of the type which can save the energy of light source use, such as a back light, and can be used using the built-in light source for the bottom of a comparatively dark atmosphere etc.

[0042] While the polarizing plate which consists of a polarizer which it reflected the linearly polarized light of a predetermined polarization shaft or the circular polarization of light of the predetermined direction when the improvement film in brightness carried out incidence of the natural light, other light shows the property to penetrate, and mentioned the improvement film in brightness above, and a protective layer, and the polarizing plate which carried out the laminating carry out the incidence of the light from the light sources, such as a back light, and obtaining the transmitted light of a predetermined polarization state, light other than the aforementioned predetermined polarization state is reflected without penetrating Reverse the light reflected by this improvement film plane in brightness through the reflecting layer in which it was prepared further at the backside, and re-incidence is carried out to the improvement board in brightness. While aiming at increase in quantity of the light which is made to penetrate the part or all as a light of a predetermined polarization state, and penetrates the improvement film in brightness, brightness can be raised by aiming at increase of the quantity of light which supplies the polarization which cannot be easily absorbed by the polarizer and can be used for liquid crystal image display etc.

[0043] As the aforementioned improvement film in brightness, like the multilayer layered product of the thin film film from which the multilayered film and refractive-index anisotropy of a dielectric are different, for example What shows the property of penetrating the linearly polarized light of a predetermined polarization shaft, and reflecting other light, One circular polarization of light of the left-handed rotation or right-handed rotations like what supported a cholesteric-liquid-crystal layer, especially the oriented film and its orientation liquid crystal layer of cholesteric-liquid-crystal polymer on the film base material is reflected, and other light can use what has the proper thing which shows the property to penetrate.
[0044] Therefore, it can be made to penetrate efficiently by arranging a polarization shaft and carrying out incidence of the transmitted light to a polarizing plate as it is, with the improvement film in brightness of the type which penetrates the linearly polarized light of the aforementioned predetermined polarization shaft, suppressing the absorption loss by the polarizing plate. On the other hand, although incidence can be carried out to a polarizer as it is with the improvement film in brightness of the type which penetrates the circular polarization of light like a cholesteric-liquid-crystal layer, it is more desirable than the point which suppresses an absorption loss to linearly-polarized-light-ize the transparency circular polarization of light through a phase contrast board, and to carry out incidence to a polarizing plate. In addition, the circular polarization of light is convertible for the linearly polarized light by using 1/4 wavelength plate as the phase contrast board.
[0045] The phase contrast board which functions as 1/4 wavelength plate in the large wavelength ranges, such as a light region, can be obtained with the method which superimposes the phase contrast layer which shows the phase contrast layer which functions as 1/4 wavelength plate to the homogeneous lights, such as light with a wavelength of 550nm, and other phase contrast properties, for example, the phase contrast layer which functions as 1/2 wavelength plate. Therefore, a polarizing plate and the phase contrast board arranged between the improvement films in brightness may consist of phase contrast more than one layer or two-layer.
[0046] In addition, also about a cholesteric-liquid-crystal layer, although reflected wave length is different, by making it combination and considering as two-layer or the arrangement structure superimposed three or more layers, what reflects the circular polarization of light in the large wavelength ranges, such as a light region, can be obtained, and the transparency circular polarization of light of the large wavelength range can be acquired based on it.
[0047] Next, the polarizing plate with which the laminating of the optical compensation film is further carried out to the polarizing plate mentioned above is explained.
[0048] The polarizing plate of this invention may carry out the one or more sheet laminating of the optical compensation film of this invention to the above-mentioned polarizing plate, and may consist of a polarizing plate, two-layer, or a thing that carried out the three or more layer laminating. Therefore, you may be a reflected type elliptically-polarized-light board, a half-transparency type elliptically-polarized-light board, etc. which combined the above-mentioned reflected type polarizing plate, the half-transparency type polarizing plate, and the optical compensation film of this invention. There is especially no limitation about the laminating method, and proper adhesion meanses, such as an adhesive layer, can be used. Although the polarizing plate which carried out the laminating of two-layer or the three or more-layer optical layer can be formed also by the method which carries out a laminating separately one by one by manufacturing processes, such as a liquid crystal display, since it excels in stability, assembly-operation nature, etc. of quality, the optical compensating plate one apparatus polarizing plate which carried out the laminating beforehand and which was made into optical faculty material has the advantage which can raise manufacture efficiency, such as a liquid crystal display.
[0049] Next, the polarizing plate which carried out the laminating of the optical compensation film of this invention to the optical compensation film of this invention or the polarizing plate mentioned above further is explained about the liquid crystal display of a liquid crystal cell arranged in one side at least.
[0050] The liquid crystal display of this invention can be formed as what has the proper structure according to the former, such as a penetrated type which comes to arrange a polarizing plate on one side or the both sides of a liquid crystal cell, and a reflected type or type both for transparency / reflective. Therefore, the liquid crystal cell which forms a liquid crystal display is arbitrary, for example, may use a liquid crystal cell proper type [, such as an active-matrix drive type thing represented by the TFT type and a simple matrix drive type thing represented by a twist nematic type and the super twist nematic type].
[0051] Moreover, when preparing a polarizing plate and an optical member in the both sides of a liquid crystal cell, they may be the same and may differ. Furthermore, on the occasion of formation of a liquid crystal display, proper parts, such as a prism array sheet, a lens array sheet, an optical diffusion board, and

a back light, can be arranged one layer or more than two-layer in a proper position, for example.
[0052] Since the optical compensation film or polarizing plate of this invention is pasted up with a liquid crystal cell, an adhesive layer can also be prepared. The adhesive layer can be suitably formed using conventionally well-known binders, such as acrylic. Especially, a moisture absorption is low and it is more desirable than points, such as a fall of the optical property by prevention of the foaming phenomenon by moisture absorption, or a peeling phenomenon, the differential thermal expansion, etc., curvature prevention of a liquid crystal cell, as a result the plasticity of a liquid crystal display that is excellent in endurance with high quality, that it is the adhesive layer which is excellent in thermal resistance. Moreover, it can also consider as the adhesive layer which contains a particle and shows optical diffusibility.
[0053] It is desirable to carry out tentative installation covering with separator for the purpose of a pollution control etc. until it presents practical use with the adhesive layer, when the adhesive layer prepared in the polarizing plate or the optical member is exposed to a front face. Separator can be formed with the method which establishes the ablation coat by proper removers, such as a silicone system, a long-chain alkyl system, a fluorine system, and a molybdenum sulfide, in the proper thin nerve according to the above-mentioned transparent protection film etc. if needed.
[0054] In addition, each class which forms the polarizing plate mentioned above and an optical member, such as a polarization film, a transparent protection film, an optical layer, and an adhesive layer, may give ultraviolet-absorption ability with a method with the proper method processed with ultraviolet ray absorbents, such as for example, a salicylate system compound, a benzophenone system compound, a benzotriazol system compound, and a cyanoacrylate system compound, a nickel complex salt system compound. Next, an example explains this invention concretely.
[0055]
[Example] (Example 1) The equipment which extends a poly norbornene system resin film (the product made from JSR, tradename "an ATON film") with a thickness of 100 micrometers using a peripheral-speed difference among two pairs of pinch rolls is used. After extending to lengthwise by the extension temperature of 180 degrees C, and 1.10 times as many draw magnification as this, the tenter (2.1 rail aperture angles) was used, it extended in the longitudinal direction by the extension temperature of 180 degrees C, and 1.50 times as many draw magnification as this, and the optical compensation film whose thickness of the center of a film is 66 micrometers and width of face of 450mm was produced.
[0056] (Example 1 of comparison) A tenter (2.1 rail aperture angles) is used for a poly norbornene system resin film (the product made from JSR, tradename "an ATON film") with a thickness of 100 micrometers. After extending in a longitudinal direction by the extension temperature of 180 degrees C, and 1.50 times as many draw magnification as this, the equipment extended using a peripheral-speed difference among two pairs of pinch rolls was used, it extended to lengthwise by the extension temperature of 180 degrees C, and 1.10 times as many draw magnification as this, and the optical compensation film whose thickness of the center of a film is 66.5 micrometers and width of face of 430mm was produced.
[0057] (Characterization of an optical compensation film) When the principal indices of refraction of nx, ny, and the thickness direction were set [the thickness of the optical compensation film of the above-mentioned example and the example of comparison] to nz for the principal indices of refraction in d and a film plane, Re=(nx-ny) d of the center of a film, Rth=(nx-nz) d, and Re/Rth were measured with the automatic double refractive-index plan made from a royal prince measuring instrument (KOBRA21ADH). Moreover, in order to measure the variation in Re of the cross direction of an optical compensation film, crosswise Re was measured and the rate over the film full of the film width of face which has the difference of Re of the center of a film and crosswise Re in less than **10% of range was calculated. The result is shown in Table 1.
[0058]
[Table 1] Table [ ] Re Rth. Re/Rth The degree of axial angle of shaft orientations Crosswise property variation (nm) (nm) Variation (deg) less than 10% -- comparatively -- (%) Example 1 58.7 157.8 0.37 9 Example 1 of 65 comparison 55.9 143.8 0.39 7 58 . [0059] The optical compensation film of this invention has little crosswise degree variation of axial angle compared with the optical compensation film of the example of comparison, and it turns out that it excels in the homogeneity within a field so that clearly from the above-mentioned result. [0060] (Example 2) The elliptically-polarized-light board which consists of a layered product of the optical compensation film produced in the example 1 and a polyvinyl alcohol system polarizing plate was pasted up on the both sides of a STN type liquid crystal cell, and display was formed. Consequently, it was wide range, and coloring was not accepted but the contrast ratio was also good.
[0061]

[Effect of the Invention] Since biaxial stretching of the thermoplastics film is serially carried out in the order of lengthwise and a longitudinal direction and the second process serves as fixed-end horizontal extension, this invention does not have the neck in of a film, as explained above. Consequently, the military requirement of a film is satisfied, and the manifestation of the 2 shaft property of an optical compensation film is easy, and can offer the optical compensation film excellent in the homogeneity in a film plane.

CLAIMS

[Claim(s)]

[Claim 1] The manufacture method of the optical compensation film characterized by carrying out biàxial stretching of the thermoplastics film serially in the order of lengthwise and a longitudinal direction.

[Claim 2] The manufacture method according to claim 1 that the ratios of horizontal draw magnification and vertical draw magnification are 0.2-5.0.

[Claim 3] The optical compensation film with which the retardation value within a field (Re=(nx-ny) d) is manufactured by the way according to claim 1 or 2 the retardation values (Rth=(nx-nz) d) of 0-500nm and the thickness direction are 0-500nm and Re/Rth<1 when the principal indices of refraction of nx, ny, and the thickness direction are made [the thickness of a film] into nz and nx>ny for the principal indices of refraction in d and a film plane.

[Claim 4] The optical compensation film according to claim 3 100-300nm and whose Rth/Re the retardation value (Rth) of 10-100nm and the thickness direction is 1-4 for the retardation value within a field (Re).

[Claim 5] The optical compensation film according to claim 3 or 4 whose retardation distribution within a crosswise field is **10% of within the limits in 80% or more of sheet width of face.

[Claim 6] An optical compensation film given in the claim 3 whose thermoplastics film is a norbornene system resin film - 5 any 1 terms.

[Claim 7] The polarizing plate which consists of a layered product of the optical compensation film and polarizing plate which were manufactured by the method of claims 1 or 2.

[Claim 8] The polarizing plate which becomes any 1 term of claims 3-6 from the layered product of the optical compensation film of a publication, and a polarizing plate.

[Claim 9] About an optical compensation film given in any 1 term of claims 3-6, it is the liquid crystal display of a liquid crystal cell arranged in one side at least.

[Claim 10] About a polarizing plate according to claim 7 or 8, it is the liquid crystal display of a liquid crystal cell arranged in one side at least.

[Translation done.]